

CLAIMS

What is claimed is:

1. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 1.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
2. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 5.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
3. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 10.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
4. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 15.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
5. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 20.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
6. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 25.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
7. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 30.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
8. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 40.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
9. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 50.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
10. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises at least 60.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.
11. The oilseed plant of any of Claims 1-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid.
12. The oilseed plant of any of Claims 1-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA.

13. The oilseed plant of any of Claims 3-10 wherein the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

14. The oilseed plant of any of Claims 3-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

15. The oilseed plant of any of Claims 3-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA, and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

16. Seeds obtained from the plant of any of Claims 1-10.

17. Seeds obtained from the plant of any of Claims 1-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid.

18. Seeds obtained from the plant of any of Claims 1-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA.

19. Seeds obtained from the plant of any of Claims 3-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

20. Seeds obtained from the plant of any of Claims 3-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA, and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

21. Oil obtained from the seeds of the plants of any of Claims 1-10.

22. Oil obtained from the seeds of the plants of any of Claims 1-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid.

23. Oil obtained from the seeds of the plants of any of Claims 1-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA.

24. Oil obtained from the seeds of the plants of any of Claims 3-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

25. Oil obtained from the seeds of the plants of any of Claims 3-10 wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA, and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

26. The plant of any of Claims 1-10 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, and safflower.

27. The plant of any of Claims 1-10 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, and safflower, and further wherein the polyunsaturated fatty acid is an omega-3 fatty acid.

28. The plant of any of Claims 1-10 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, and safflower, and further wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA.

29. The plant of any of Claims 3-10 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, and safflower, and further wherein the polyunsaturated fatty acid is an omega-3 fatty acid and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

30. The plant of any of Claims 3-10 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, and safflower, and further wherein the polyunsaturated fatty acid is an omega-3 fatty acid selected from the group consisting of EPA, DPA, and DHA, and the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.

31. A recombinant construct for altering the total fatty acid profile of mature seeds of an oilseed plant, said construct comprising at least two promoters wherein each promoter is operably linked to a nucleic acid sequence encoding a polypeptide required for making at least one polyunsaturated fatty acid having at least twenty carbon atoms and four or more carbon-carbon double bonds and further wherein the total fatty acid profile comprises at least 2% of at least one polyunsaturated fatty acid having at least twenty carbon atoms and four or more carbon-carbon double bonds and further wherein said polypeptide is an enzyme selected from the group consisting of a  $\Delta$  4 desaturase, a  $\Delta$  5 desaturase,  $\Delta$  6 desaturase, a  $\Delta$  15 desaturase, a  $\Delta$  17 desaturase, a C18 to C22 elongase and a C20 to C24 elongase.

32. The recombinant construct of Claim 31 wherein the promoter is selected from the group consisting of the alpha prime subunit of beta conglycinin promoter, Kunitz trypsin inhibitor 3 promoter, annexin promoter, Gly1 promoter, beta subunit of beta conglycinin promoter, P34/Gly Bd m 30K promoter, albumin promoter, Leg A1 promoter and Leg A2 promoter.

33. An oilseed plant comprising in its genome the recombinant construct of Claim 31.

34. An oilseed plant comprising in its genome the recombinant construct of Claim 32.

35. The oilseed plant of Claim 33 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, safflower.

36. The oilseed plant of Claim 34 wherein the oilseed plant is selected from the group consisting of soybean, Brassica species, sunflower, maize, cotton, flax, safflower.

37. Seeds obtained from the plant of Claim 33.

38. Seeds obtained from the plant of Claim 34.

39. Seeds obtained from the plant of Claim 35.

40. Seeds obtained from the plant of Claim 36.

41. Oil obtained from the seeds of Claim 37.

42. Oil obtained from the seeds of Claim 38.

43. Oil obtained from the seeds of Claim 39.

44. Oil obtained from the seeds of Claim 40.

45. A method for making an oilseed plant having an altered fatty acid profile which comprises:

a) transforming a plant with the recombinant construct of Claim 31;

b) growing the transformed plant of step (a); and

c) selecting those plants wherein the total fatty acid profile comprises at least 1.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.

46. An oilseed plant made by the method of Claim 30.

47. Seeds obtained from the plant of Claim 31.

48. Oil obtained from the seeds of Claim 32.

49. A method for making an oilseed plant having an altered fatty acid profile which comprises:

a) transforming a plant with the recombinant construct of Claim 32,

b) growing the transformed plant of step (a); and

c) selecting those plants wherein the total fatty acid profile comprises at least 1.0 % of at least one polyunsaturated fatty acid having at least twenty carbon atoms and five or more carbon-carbon double bonds.

50. An oilseed plant made by the method of Claim 34.

51. Seeds obtained from the plant of Claim 35.

52. Oil obtained from the seeds of Claim 36.

53. A food product or food analog which has incorporated therein the oil of Claim 21.

54. A food product or food analog which has incorporated therein the oil of Claim 41.

55. A food product or food analog which has incorporated therein the oil of Claim 42.

5 56. A food product or food analog which has incorporated therein the oil of Claim 43.

57. A food product or food analog which has incorporated therein the oil of Claim 44.

10 58. A food product or food analog which has incorporated therein the oil of Claim 48.

59. A food product or food analog which has incorporated therein the oil of Claim 52.

15 60. The food product of Claim 53 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food, animal feed or aquaculture feed.

20 61. The food product of Claim 54 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food, animal feed or aquaculture feed.

25 62. The food product of Claim 55 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food, animal feed or aquaculture feed.

30 63. The food product of Claim 56 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food, animal feed or aquaculture feed.

35 64. The food product of Claim 57 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food, animal feed or aquaculture feed.

65. The food product of Claim 58 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food,  
5 animal feed or aquaculture feed.

66. The food product of Claim 59 wherein said product is selected from the group consisting of a spray-dried food particle, a freeze-dried food particle, meat products, a cereal food, a snack food, a baked good, an extruded food, a fried food, a health food, a dairy food, meat analogs, cheese analogs, milk analogs, a pet food,  
10 animal feed or aquaculture feed.

67. A beverage which has incorporated therein the oil of Claim 21.

68. A beverage which has incorporated therein the oil of Claim 41.

69. A beverage which has incorporated therein the oil of Claim 42.

70. A beverage which has incorporated therein the oil of Claim 43.

71. A beverage which has incorporated therein the oil of Claim 44.

72. A beverage which has incorporated therein the oil of Claim 48.

73. A beverage which has incorporated therein the oil of Claim 52.

74. Infant formula which has incorporated therein the oil of Claim 21.

75. Infant formula which has incorporated therein the oil of Claim 41.

76. Infant formula which has incorporated therein the oil of Claim 42.

77. Infant formula which has incorporated therein the oil of Claim 43.

78. Infant formula which has incorporated therein the oil of Claim 44.

79. Infant formula which has incorporated therein the oil of Claim 48.

80. Infant formula which has incorporated therein the oil of Claim 52.

81. A nutritional supplement which has incorporated therein the oil of Claim 21.

82. A nutritional supplement which has incorporated therein the oil of Claim 41.

83. A nutritional supplement which has incorporated therein the oil of Claim 42.

84. A nutritional supplement which has incorporated therein the oil of Claim 43.

85. A nutritional supplement which has incorporated therein the oil of Claim 44.

86. A nutritional supplement which has incorporated therein the oil of Claim 48.

87. A nutritional supplement which has incorporated therein the oil of Claim 52.

88. A food product or food analog which has incorporated therein the seed of Claim 13.

89. A food product or food analog which has incorporated therein the seed of Claim 37.

5 90. A food product or food analog which has incorporated therein the seed of Claim 38.

91. A food product or food analog which has incorporated therein the seed of Claim 39.

10 92. A food product or food analog which has incorporated therein the seed of Claim 40.

93. A pet food which has incorporated therein the seed of Claim 16.

94. A pet food which has incorporated therein the seed of Claim 37.

95. A pet food which has incorporated therein the seed of Claim 38.

96. A pet food which has incorporated therein the seed of Claim 39.

15 97. A pet food which has incorporated therein the seed of Claim 40.

98. Animal feed which has incorporated therein the seed of Claim 16.

99. Animal feed which has incorporated therein the seed of Claim 37.

100. Animal feed which has incorporated therein the seed of Claim 38.

101. Animal feed which has incorporated therein the seed of Claim 39.

20 102. Animal feed which has incorporated therein the seed of Claim 40.

103. A pet food which has incorporated therein the oil of Claim 21,

104. A pet food which has incorporated therein the oil of Claim 41.

105. A pet food which has incorporated therein the oil of Claim 42,

106. A pet food which has incorporated therein the oil of Claim 43,

25 107. A pet food which has incorporated therein the oil of Claim 44,

108. A pet food which has incorporated therein the oil of Claim 48,

109. A pet food which has incorporated therein the oil of Claim 52,

110. Animal feed which has incorporated therein the oil of Claim 21.

111. Animal feed which has incorporated therein the oil of Claim 41.

30 112. Animal feed which has incorporated therein the oil of Claim 42.

113. Animal feed which has incorporated therein the oil of Claim 43.

114. Animal feed which has incorporated therein the oil of Claim 44.

115. Animal feed which has incorporated therein the oil of Claim 48.

116. Animal feed which has incorporated therein the oil of Claim 52.

35 117. A whole bean soy product made from the seed of Claim 16.

118. A whole bean soy product made from the seed of Claim 37.

119. A whole bean soy product made from the seed of Claim 38.

120. A whole bean soy product made from the seed of Claim 39.

121. A whole bean soy product made from the seed of Claim 40.
122. An aquaculture food product which has incorporated therein the oil of Claim 21.
- 5 123. An aquaculture food product which has incorporated therein the oil of Claim 41.
124. An aquaculture food product which has incorporated therein the oil of Claim 42.
125. An aquaculture food product which has incorporated therein the oil of Claim 43.
- 10 126. An aquaculture food product which has incorporated therein the oil of Claim 44.
127. An aquaculture food product which has incorporated therein the oil of Claim 48.
128. An aquaculture food product which has incorporated therein the oil of Claim 52.
- 15 129. An aquaculture food product which has incorporated therein the seed of Claim 16.
130. An aquaculture food product which has incorporated therein the seed of Claim 37.
- 20 131. An aquaculture food product which has incorporated therein the seed of Claim 38.
132. An aquaculture food product which has incorporated therein the seed of Claim 39.
133. An aquaculture food product which has incorporated therein the seed of Claim 40.
- 25 134. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises polyunsaturated fatty acids having at least twenty carbon atoms and five or more carbon-carbon double bonds wherein the ratio of EPA:DHA is in the range from 1:100 to 860:100.
- 30 135. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises polyunsaturated fatty acids having at least twenty carbon atoms and five or more carbon-carbon double bonds wherein the ratio of EPA:DHA is in the range from 1:100 to 860:100 and further wherein the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.
- 35 136. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises polyunsaturated fatty acids having at least twenty carbon atoms and five or more carbon-carbon double bonds wherein the ratio of DHA:EPA is in the range from 1:100 to 110:100.



137. An oilseed plant that produces mature seeds in which the total seed fatty acid profile comprises polyunsaturated fatty acids having at least twenty carbon atoms and five or more carbon-carbon double bonds wherein the ratio of DHA:EPA is in the range from 1:100 to 110:100 and further wherein the total seed fatty acid profile further comprises less than 2.0% arachidonic acid.
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138. Seeds obtained from the plant of any of Claims 134-137.
139. Oil obtained from the seeds of the plants of any of Claims 134-137.